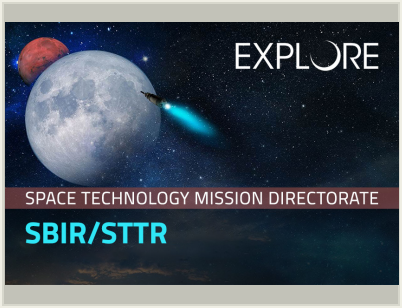
Compact Low-Power Driver for Deformable Mirror Systems, Phase I

Completed Technology Project (2010 - 2010)

Project Introduction

Boston Micromachines Corporation (BMC), a leading developer of unique, high-resolution micromachined deformable mirrors (DMs), will develop a compact, low-power, high-voltage multiplexed driver suitable for integration with those DMs in space-based wavefront control applications. The proposed driver architecture will drastically reduce power consumption and size. Based on parameters measured using an existing 993-actuator DM that BMC developed for NASA in support of the Terrestrial Planet Finding Coronagraph program, and using projections from preliminary experiments conducted for this proposal, we predict at minimum a hundred-fold reduction in power consumption in the prototype driver to be produced in Phase I, and a tenfold reduction in size, while maintaining high precision, reducing electronics driver cost, and reducing interconnection complexity. Additional reductions in power consumption and another tenfold reduction in size will follow in Phase II work when the core design is transferred to implementation in application-specific integrated circuit (ASIC) format. Phase I work involves collaboration between BMC and Boston University (BU). A leading electrostatics research group at BU will develop a novel multiplexed high-voltage driver architecture that comprises a significant departure from previous MEMS DM drivers. A single D/A converter and high-voltage amplifier module will drive the entire array through a row-column addressing scheme. This approach will reduce operational power consumption by two orders of magnitude from ~80W to ~0.8W. We will also integrate the DM and the mirror into a compact package. The MEMS DM and the electronics will be co-mounted on the same PC board. This will reduce driver volume by an order of magnitude, from ~20,000cc to 2000cc. It will also eliminate the need for high density cabling and buffer amplifiers used to drive them, simplifying system operation and further reducing power consumption and size.



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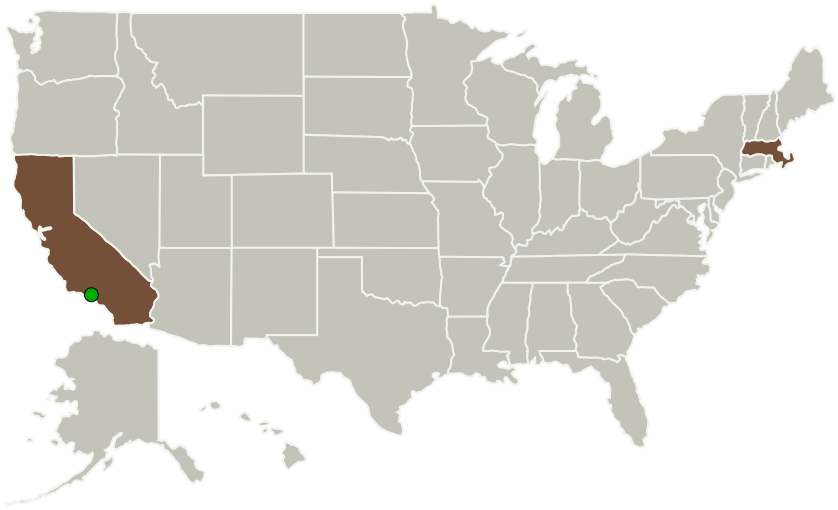
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Boston Micromachines Corporation	Lead Organization	Industry	Cambridge, Massachusetts
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Massachusetts

Project Transitions

January 2010: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Boston Micromachines Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Steven A Cornelissen

Co-Investigator:

Steven Cornelissen

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Completed Technology Project (2010 - 2010)

July 2010: Closed out

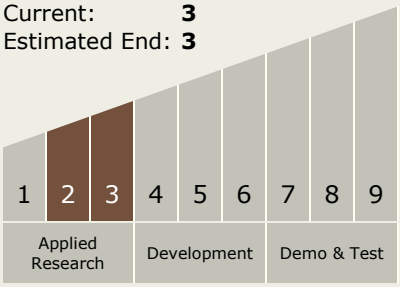
Closeout Summary: Compact Low-Power Driver for Deformable Mirror System s, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/140016)*

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.2 Observatories
    - TX08.2.1 Mirror Systems

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System